

### REMARKS

Favorable reconsideration and allowance of this application are requested.

By way of the amendment instructions above, the claims have been amended and new claims added so as to clarify the presently claimed subject matter. Following entry of the present amendment, therefore, claims 1-21 will remain pending herein of which claims 1 and 10 are in independent format.

The only issue remaining to be resolved in this application is the Examiner's rejection of prior claims 1-13 under 35 USC §103(a) as unpatentable over JP 2127596 in view of Glasser et al (USP 5,900,479). As will become evident from the discussion which follows, neither JP '596 nor Glasser et al is appropriate as a reference against the claims now pending in this application.

Applicants note that the present invention is novel in several respects. For example, the present invention is novel in that a support formed of an organic and/or inorganic fiber substrate is coated with a chitosan-based solution using minimal (usually only a single) number of coats. In accordance with the present invention, this beneficial attribute is achieved by incorporating **prehydrolyzed** chitosan (i.e., chitosan which has been prehydrolyzed to achieve a relatively low molecular weight of <130,000) in an aqueous solution and then coating the solution on a fibrous substrate.

Specifically, as described on page 4, line 30 onwards of the originally filed specification, according to the present invention, chitosan is subjected to a hydrolyzing treatment so as to lower its molar mass which in turn lowers its viscosity. After the hydrolyzing step, the now prehydrolyzed chitosan is dissolved in an aqueous solution, preferably with the aid of an organic or inorganic acid and then coated onto a substrate formed of organic and/or inorganic fibers.

Turning attention to the applied references of record, applicants have obtained a partial translation of the JP '596 reference's claims and examples and attach a copy thereof for the Examiner's consideration. A study of this translation reveals significant differences exist between its disclosure and the presently claimed invention. For example, according to the JP '596 reference, the way the chitosan solution is brought into contact with the base material is impregnation, which is a totally different method than the presently claimed "coating". In this regard, the impregnation of the JP '596 reference is done by immersing the Japanese paper for a short period of time (not defined) in the chitosan solution, by pulling the paper up and by drying the paper. The impregnation of course causes the chitosan solution to be present all over the paper, not only on the surface of the fibrous support as in the present invention. Thus, according to the JP '596 reference no "coating" of the substrate occurs, and in fact by means of impregnation one is not able to get a good coating. Even if it is assumed that a functionally corresponding result is achieved by the impregnation technique disclosed in the JP '596 reference, much more chitosan is needed, as it is spread all over the thickness of the base material.

Secondly, the consistency taught by the examples in the JP '596 reference is very low, i.e., 2 percent maximum, whereas in the present invention the consistency of the coating solution is 6% and above up to 30%. (Applicants therefore are perplexed as to where the Derwent abstract gets its 1 to 20 wt,% range if the examples of the JP '596 reference only mention impregnation and a consistency of 2% max.)

Glasser fails to cure the deficiencies of the JP '596 reference. Specifically, applicants note that Glasser discusses combining the chitosan starting material (see column 3, lines 44 - 67) with a dilute organic acid so that the acid combines with the free amine groups on chitosan to produce a chitosonium ion complex. The complex is then the material that may be extruded to form films, fibers, filaments, or may also be used as a coating (column 4, lines 27 - 42).

While Glasser also mentions viscosity in such passages, it is done so only in terms that the viscosity of the complex can be adjusted by means of evaporation. Those of even ordinary skill in the art would recognize that evaporation causes the solution viscosity to **increase**. This increase in viscosity of course goes hand in hand with the formation of films by extrusion, for example. After the extrusion, or coating, heating is applied by Glasser so as to convert ammonium organic acid ionic groups to N-organic acid groups.

In other words, the actual disclosure of Glasser, while relating to formation of chitosan films, it is done **not** by using low viscosity (low molecular weight) chitosan. Significantly, Glasser does not teach at all the use of hydrolysis so as to reduce the molar mass of chitosan as is accomplished according to the present invention. Thus, while Glasser may disclose a molecular weight range which in theory overlaps with the range defined in the present invention (i.e., 10,000 – 1,000,000 of Glasser (column 3, lines 50 - 51) vs. <130,000 as claimed herein), the Glasser reference does not disclose coating a substrate with a **prehydrolyzed** chitosan having relatively low (i.e., <130,000) molecular weight and hence relatively low viscosity.

Therefore, even if an ordinarily skilled person combine Glasser with the JP '596 reference, the present invention would not result. As such, withdrawal of the rejection advanced under 35 USC §103(a) is in order.

Every effort has been made to advance prosecution of this application to allowance. Therefore, in view of the amendments and remarks above, applicant suggests that all claims are in condition for allowance and Official Notice of the same is solicited.

Should any small matters remain outstanding, the Examiner is encouraged to telephone the Applicants' undersigned attorney so that the same may be resolved without the need for an additional written action and reply.

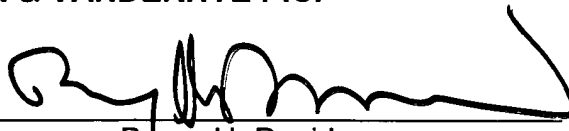
**DOMARD et al**  
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An early and favorable reply on the merits is awaited.

Respectfully submitted,

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## Translation

(Unofficial translation which should not be used in patent disputes)

Source: Japan. Kokai **JP 2-127596** (1990)

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### 1. Title of the Invention

Converted paper and its production method.

### 2. Scope of Patent Claims

1. Converted paper made by supporting chitin and/or chitosan on the base paper.
2. Converted paper mentioned in Claim 1, where the amount of chitin and/or chitosan supported on the base paper is  $0.5\text{-}30\text{ g/m}^2$  on the dry basis.
3. Production method of the converted paper characterized in that the base paper is first contacted with an acidic aqueous solution of chitin and/or chitosan and then dried.
4. Production method, which is mentioned in Claim 3 and which is characterized in that a heat treatment is carried out after drying.
5. Production method of the converted paper characterized in that the base paper is first contacted with an acidic aqueous solution of chitin and/or chitosan and then treated with an alkali.

### 3. Detailed Description of the Invention

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#### Realization Examples

Next, the invention is further explained by giving the realization examples. "Part" and "%" used below indicate quantities on the weight basis.

#### *Production of the converted paper 1*

##### **Realization Example 1**

A solution containing 0.5 parts of chitin (produced by Nanyo Kasei Co.), 0.5 parts of chitosan (produced by Nanyo Kasei Co.), 1 part of acetic acid and 98 parts of water was prepared. Japanese paper with a grammage of  $20\text{ g/m}^2$  was impregnated for a short period in the solution,

and then pulled up and dried with hot air at 80 °C for 2 min. The combined supported amount of chitin and chitosan was 1 g/m<sup>2</sup> on the dry basis.

Moreover, the dried converted paper was further heat-treated for 2 min at 130 °C.

### **Realization Example 2**

A solution containing 1 part of a partially converted product from production of chitosan from chitin (about 10 % of chitin units and 90 % of chitosan units), 1 part of acetic acid and 98 parts of water was prepared. Japanese paper with a grammage of 20 g/m<sup>2</sup> was impregnated for a short period in the solution, and then pulled up and dried with hot air at 90 °C for 2 min. The supported amount of the partially converted chitin-chitosan product was 3 g/m<sup>2</sup> on the dry basis.

Moreover, the dried converted paper was further heat-treated for 3 min at 120 °C.

### **Realization Example 3**

A solution containing 1 part of chitosan, 1 part of acetic acid and 98 parts of water was prepared. Japanese paper with a grammage of 20 g/m<sup>2</sup> was impregnated for a short period in the solution, and then pulled up and dried with hot air at 80 °C for 5 min. The supported amount of chitin (should be “chitosan”, translator’s note) was 5 g/m<sup>2</sup> on the dry basis.

Moreover, the dried converted paper was further heat-treated for 2 min at 130 °C.

### **Reference Example 1**

An aqueous solution containing 1.5 % of viscose was prepared. Japanese paper with a grammage of 20 g/m<sup>2</sup> was impregnated for a short period in the solution and then pulled up. Viscose was regenerated by coagulation and the paper was dried with hot air at 80 °C for 2 min. The supported amount of viscose was 1 g/m<sup>2</sup> on the dry basis.

Moreover, the dried viscose-impregnated paper was further heat-treated for 2 min at 130 °C.

### **Reference Example 2**

A viscose-converted paper was prepared by impregnating the viscose-treated paper obtained in Reference Example 1 further with viscose and by regenerating viscose by coagulation. The total supported amount of viscose was 40 g/m<sup>2</sup> on the dry basis.

### **Reference Example 2**

The Japanese paper with a grammage of 20 g/m<sup>2</sup>, which was used in the Realization examples 1-4 and in the Reference Examples 1-2.

*Measurement of the wet tensile strength*

The transverse tensile strength of each converted paper mentioned above as well as of the Japanese paper of Reference Example 3 was measured according to JIS P-8135 "Test method for the wet tensile strength of paper and paper-board". However, in the Reference Examples 1 and 2 the paper was washed by immersing in 80 °C water for 5 min and then dried before measurements.

The results are shown in Table 1.

Table 1.

	Heat treatment	Supported amount (g/m <sup>2</sup> )	Tensile strength (g/15 mm)	Wet tensile strength (g/15 mm)
Realization Example 1	No	1	825	660
	Yes	1	1100	880
Realization Example 2	No	3	900	720
	Yes	3	1150	920
Realization Example 3	No	5	950	780
	Yes	5	1200	960
Reference Example 1	No	1	}800	}640
	Yes	1		
Reference Example 2	No	40	}5900	}4800
	Yes	40		
Reference Example 3	-	-	460	320

The converted papers obtained in the Realization Examples 1-3 (those obtained after drying and those obtained after heat treatment) and the Japanese paper of the Reference Example 3 were attached on the walls of a chamber and appearance of mold was investigated. Appearance of mold in the converted papers obtained in the Realization Examples 1-3 was not observed even after 1 month from the appearance in the Japanese paper of the Reference Example 3. The converted papers of the Realization Examples 4 and 5 mentioned below behaved similarly.

When writing with a water-based ink on the converted papers obtained in the Realization Examples 1-3 (after drying and after heat treatment), excellent ink receptivity, rapid drying and good fading resistance were observed. The converted papers of Realization Examples 4 and 5 mentioned below behaved similarly.

*Production of the converted paper 2***Realization Example 4**

A solution containing 0.3 parts of chitin, 1.7 parts of chitosan, 2 part of acetic acid and 96 parts of water was prepared. Japanese paper with a grammage of  $20 \text{ g/m}^2$  was impregnated for a short period in the solution, and then pulled up and dried with hot air at  $90^\circ\text{C}$  for 15 min. The paper was then neutralized by treating in a sodium carbonate solution and finally washed. After washing, the paper was dried with hot air at  $90^\circ\text{C}$  for 5 min. The total supported amount of chitin and chitosan was  $10 \text{ g/m}^2$  on the dry basis.

The wet tensile strength of the converted paper obtained was  $1000 \text{ g/15 mm}$ .

**Realization Example 5**

A solution containing 1 part of chitosan, 1 part of acetic acid and 98 parts of water was prepared. Kraft paper with a grammage of  $20 \text{ g/m}^2$  was impregnated for a short period in the solution, and then pulled up and dried with hot air at  $80^\circ\text{C}$  for 2 min. The paper was then heat-treated at  $130^\circ\text{C}$  for 5 min. The supported amount of chitosan after drying and heat-treatment was  $5 \text{ g/m}^2$  on the dry basis.

The wet tensile strength of the converted paper obtained was  $960 \text{ g/15 mm}$ . The wet tensile strength of the Kraft paper used above was  $320 \text{ g/15 mm}$

**Efficiency of the Invention**

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